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Eradicating Perennial Weeds with Carbon Bisulphide

by

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COOPERATIVE EXTENSION SERVICE IN AGRICULTURE AND HOME ECONOMICS OF THE STATE OF IDAHO, UNIVERSITY OF IDAHO COLLEGE OF AGRICULTURE, AND UNITED STATES DEPARTMENT OF AGRICULTURE, COOPERATING

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Applying carbon bisulphide to area infested with morning glory. Worker at extreme right is probing holes 18 inches apart as marked by string. Center—pouring carbon bisulphide using a long spouted funnel having 2-ounce cup mounted on a swivel in top of funnel, and a teakettle as a convenient container for pouring. Left—worker, following closely, thoroughly tamping holes in which the material has been placed.

Eradicating Perennial Weeds with Carbon Bisulphide

H. L. Spence, Jr.*

Introduction

In the search for efficient herbicides for use in perennial weed eradication, many chemicals have been thoroughly tested by the University of Idaho Agricultural Experiment Station and Extension Service. Out of the long list, only two—carbon bisulphide and sodium chlorate—have proven sufficiently effective to warrant recommending their use under Idaho conditions.

The first experimental work in Idaho with carbon bisulphide was conducted in 1926 on the station farm at Moscow where areas infested with wild morning glory were treated. So promising were these initial trials that the following year plots were treated in other areas of the State for the purpose of determining efficient and economical methods of application. Similar trials have been carried out each year since this early work. From these first experimental plots, the use of carbon bisulphide in Idaho has steadily grown until in 1936 nearly 350,000 gallons of this material were used in organized weed districts throughout the State.

Carbon bisulphide is a heavy liquid weighing approximately 10.5 pounds per gallon, manufactured by the interaction of hard wood charcoal and sulphur vapors at 900 to 1000 degrees centigrade, condensed and collected under water and refined through stills to remove hydrogen sulphide, high boiling sulphides and sulphur. The distillate is condensed and the refined disulphide stored under water. The material used for weed work usually is shipped in steel drums containing 50 to 55 gallons per drum, which weigh approximately 650 pounds. Carbon bisulphide is a very volatile and inflammable material, yet with ordinary precautions, similar to those used in handling gasoline, it may be utilized with safety and confidence. Carbon bisulphide is non-poisonous and can be used safely on areas where livestock might be grazing.

Two types of bisulphide have been used in Idaho, namely: (1) "Crystal Clear" and (2) "Activated." The latter material is a patented article containing catalytic agents which tend to hold the material in the soil over a longer period of time. It can readily be distinguished by its red color as compared to the water-white color of the "Crystal." Results to date have shown this material necessary only for the lighter, sandy soils where rapid diffusion of gases takes place. However, as the price for the two materials is about equal, the "Activated" material is more widely used throughout the State.

Carbon bisulphide is applied by probing holes in the soil at regular spacing into which measured amounts of the material are poured. The holes are "sealed" by tamping and the ground mulched to prevent crack-

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ing and evaporation of the gases. The liquid volatilizes rapidly into a gas which is approximately 2½ times heavier than air. The gas diffuses and penetrates through the soil structure in a downward movement and comes in contact with the roots, causing decomposition. Carbon bisulphide is used successfully in Idaho on perennial weeds such as wild morning glory, Russian knapweed, white top or hoary cress, Canada thistle, leafy spurge, perennial sow thistle, perennial ground cherry, blue flowering lettuce, and other deep-rooted perennials. White top and leafy spurge have been the most difficult of this group to eradicate although treatment generally has been successful. Quack grass, because of its shallow rooting, has not been successfully controlled by this material with present methods of application. This is due to failure to hold the gases in the surface areas long enough to kill the shallow roots of this weed. Additional work is being carried out at present in an effort to develop certain "cover" methods which might prove successful for shallow rooted plants.

Limitations

During the past few years, through increased consumption and modern manufacturing facilities, the cost of carbon bisulphide has been greatly reduced. Except in special cases, its use is confined to relatively small areas. Chemical measures usually are looked upon as too costly for practical use, yet a few small patches of perennial noxious weeds may reduce the value of an entire farm. One hundred dollars spent on a single acre invariably enhances the total valuation, consequently the cost of eradicating a single acre of weeds should be assessed to the entire farm rather than to the acreage treated.

Chemical weed measures in all forms are considered practical, and are recommended only for scattered patches and practicality, even then, is dependent upon economic and cropping conditions of the farm. Most of the infested lands treated with carbon bisulphide are returned to production within one season following treatment; therefore initial cost is soon absorbed by quick, permanent restoration.

Applications in dry ground have not been wholly successful so far, therefore the use of carbon bisulphide should be restricted to areas where, and when, moisture is available. Application during winter months or freezing weather are not conducive to success for the reason that volatility and diffusion are retarded at low temperatures. Months of warm or hot temperatures are preferable.

Carbon bisulphide may be used on a wide range of soil types, but has been found to be less successful on extremely heavy types usually classified as "adobe" soils. Under such conditions penetration of gas vapor is not always possible even when spacings are reduced between holes. Shallow top soils with an underlay of heavy gravel have not yielded to treatment due to rapid diffusion and fast downward movement of the gases. Satisfactory results in water-logged soils, or soils in which water stands within 12 to 18 inches of the surface, are difficult to obtain for the reason that water is the lighter of the two liquids and carbon bisulphide sinks below the water level too fast to effect a kill.

Method of Application

Preparation.

The first step in using carbon bisulphide for weed eradication is the proper preparation of the areas to be treated. The ground should be cleaned of vegetation sufficient to make the probed holes clearly visible, thus eliminating the chance of "Skips" in the pouring or tamping operations. The rapid downward penetration of the gases sometimes fails to kill roots within the top three inches and by crowning the patches, reestablishment of plants from surface roots can be prevented. This operation can be done with a shovel, heavy hoe or with a blade or duckfoot weeder, but care must be taken not to go deeper than 3 inches to prevent the loosening of the soil too much, which might cause rapid loss of gases. Crowning may be done either before treatment or three weeks following treatment. Some soils do not require crowning, therefore by waiting until three weeks after treatment any surface growth which may appear can easily be crowned before it has an opportunity to reestablish itself.

Watering.

For ease in application, penetration, and for sealing purposes, a reasonable amount of moisture is essential. Dry farm lands should be treated during periods when the soil moisture is high, at least in the top soil. Irrigation, if available, may be applied to dry lands during proper seasons for application.

Experience has shown that moisture to a depth of 12 inches to 14 inches is sufficient in most types of land. This should not be a saturated condition, but rather one where the moisture has been allowed to equalize to a point where the soil will ball lightly in one hand when pressed with the fingers. Excessive moisture, or "muddy" condition has a tendency to "case" or "wall" the holes and prevent absorption of material.

Tools.

Tools used in applying carbon bisulphide consist of a prod (1-inch iron rod 3 feet 6 inches long, with a sharp hardened point tapered 1¾ inches long). A "T" handle about 12 inches long is brazed across the top, and a step is welded on the side, 8 inches from the point of the probe. A ½-inch galvanized pipe, 2 feet long to which a funnel and measuring cup (2 oz. capacity) are attached, is used for measuring and pouring the liquid. These outfits usually are made by local blacksmiths, or may be purchased commercially from manufacturers of carbon bisulphide at about $2.50 per set.

In addition to the tools mentioned above, the following list of accessories is essential in application:

A teakettle or some other convenient container to be used in pouring the liquid into the measuring cup.

A "tamp" for closing the holes may be made from a piece of pine 4 by 4 inches, 5½ feet in length. Taper from a diameter of 3 inches at the bottom to a point 12 to 15 inches above. Allow 8 inches or 10 inches of the handle to remain intact and taper from there to the top to suit the convenience of the grip. (Tools used are illustrated on page 2).

As a marker for making holes into which liquid is to be poured, a piece of small hemp rope or binder twine knotted at 18-inch intervals is satisfactory.

A bundle of stakes is essential for marking infested areas.

Two stakes will be required to hold the line in place, and two additional for marking the next point to which line is to be moved.

A hand rake for "mulching" treated plots to prevent cracking of the soil.

An automatic hand applicator designed for labor economy which probes the hole and injects the carbon bisulphide in one operation, has been developed. While this applicator appears to have a definite place in the application of carbon bisulphide, it has not as yet been given sufficient trial to warrant recommendation for general use in Idaho.

A large mechanical applicator handled under tractor power, completing the entire operation of probing, pouring and tamping, has recently been developed by a chemical manufacturer in San Francisco. Although no work has been done in Idaho with this machine, it has possibilities for large scale operation.

Treating.

When the surface accumulation of weed growth and crowns has been removed, and the soil contains proper moisture, the patch is ready for treatment. Stretch the marked line across one side of the patch and probe holes at each mark shown on the line. Holes should be uniform in depth: 8 inches for morning glory and 6 inches for nearly all other weeds. Inasmuch as the prod step is solidly welded at 8 inches, a 2-inch block may be wired to underside of the step to permit 6-inch applications.

Before beginning, inspect the infested areas to ascertain definitely the outside limits. *At least two rows* of holes should be probed and treated entirely around the outside of the infested area. This is important to prevent a straggling fringe of regrowth encircling the patch. Perennial weed underground rootstocks usually extend at least 3 feet beyond the farthest visible plant. Rows should be placed 18 inches apart and holes staggered with those in preceding rows and this may be accomplished by indenting every other row 9 inches from the starting point. All holes should be probed cleanly to their intended depth. If loose dirt tends to fill the holes, the ground should be packed by stepping on the spot where a hole is to be made, prior to probing. After the holes have been probed the material is applied by using a long-spouted funnel which has a dosage cup suspended within it. This cup holds 2 ounces, the amount to be placed in each hole. Teakettles, or small one-gallon oil cans, may be used as containers from which the material is poured into the funnel cup. At this rate approximately 2 gallons of carbon bisulphide per square rod are required. After pouring, the hole should be tamped immediately. A good job of tamping is necessary to insure proper results with carbon bisulphide. If tamping is not done thoroughly following application of material, considerable loss will result from evaporation. Metal tampers should be avoided, as a spark caused from striking a rock may cause a fire. After the patch has been treated, the surface should be mulched to prevent cracking and to insure a satisfactory seal. On small plots this can be done by the use

of a garden rake, while on larger areas a spike tooth harrow may be used, provided the spikes are set well back and the ground not disturbed more than 1½ inches in depth.

Follow-Up Work

During moderately warm to warm months, plots usually will show 50 per cent of the plants affected within five days and the remaining plants are affected at the rate of 5 to 10 per cent each day thereafter. On plots treated during late fall, during winter months, and during plant dormancy results should not be expected within several weeks, do to the less rapid diffusion of gas, and slower penetration through the soil.

The proper way to determine the extent of "kill" is to examine root systems in numerous places where treatment has been administered. If the kill is satisfactory the land may immediately be turned over in the rough for aeration purposes. Allow it to remain in the rough for two to three weeks, then stir by using a revolving, spring tooth, or drag harrow. Stir again in another ten days or two weeks. Irrigate and prepare the seed bed.

Follow-up work on treated areas is very important. If any regrowths emanate from root crowns left in the ground, these may be eliminated by using a shovel and lifting the crowns to the surface. If the patch has seeded, surface cultivation carried out at regular intervals will eradicate seedling plants. "Spotting" or individual treatment may be accorded to an occasional unaffected plant.

Where noxious weeds have been allowed to seed, it is well to plant row crops such as bean, corn, etc. for two or more seasons in order that plots may be inspected and, in event seedling growth appears, may be cultivated. Inspection should be accorded treated areas regularly, since seedlings of noxious weeds are capable of thoroughly establishing themselves within a period of six weeks after germination.

Sterility

One of the outstanding advantages of carbon bisulphide is that soil sterility results, following its application, only in rare cases. Noticeable temporary sterility sometimes occurs during the first season in deep-rooted crops, such as sugar beets, which often bear distinct effects from activated carbon bisulphide. Some crops often show marked benefit in growth which appears due to chemical reaction creating available plant food, and eliminating root insects that previously may have invaded the soil.

Precautions

Carbon bisulphide is a highly volatile liquid and it must be handled with care. The fumes are toxic and are extremely inflammable in contact with a spark, flame or excessive heat. In no case should smoking be permitted near the material. Carbon bisulphide is shipped in 14 gauge steel drums. To remove the bung from a drum use a wrench made to fit the counter-sunk hole. If such a wrench is not available, follow these directions:

General.

a. Never use a hammer and chisel to loosen a bung. To do so might cause a fire which would result in loss of the container and the material and possibly personal injury or property damage.

b. In using a Stillson wrench, place a piece of wet burlap over the entire bung before applying the wrench.

c. When bung has been partly unscrewed, pause until excess pressure within has been released before completing the operation. This applies to either the large or the small bung.

d. If a spigot is to be used, always stand the drum on end to attach it.

e. In case more air is required, unscrew the large bung adequately, but be sure to replace it tightly after withdrawing liquid, to prevent evaporation.

Storage.

a. Store carbon bisulphide in a cool place to prevent expansion and evaporation.

b. Use a tarpaulin for shade when transporting drums or other containers during warm or hot months.

c. When using from a container in the field during warm or hot months, cover it with wet burlap sacks, or hay, and keep the covering moistened.

d. Always replace bungs securely in container when they are empty.

Withdrawing Liquid.

a. When drawing the liquid from drums, do not use glass or crockery containers as they cannot be grounded against the accumulation of static electricity.

b. Drums and other metal containers filled with carbon bisulphide may be transported without difficulty as long as they are not subjected to excessive heat, and are not roughly handled.

c. Static electricity originates from two sources, namely, friction in withdrawing the liquid through a spigot and, through friction set up in displacing air in the withdrawal container, with the liquid. A fire is a rare instance, nevertheless, proper care must be taken under all circumstances.

d. The proper way is to unload a drum to the ground, dig a hole at the spigot end, place flat upon the earth bottom of this pit the container you intend to fill, and proceed. This allows the passing of any accumulation of static into the earth without causing a spark.

e. Do not hold the withdrawal container in the hand. If you desire to keep a drum on a truck or trailer during the process of drawing off the liquid, the following suggestions should be carried out:

f. Place a mental chain around the drum prior to removing the bung, drop the end to the earth and bury in moist dirt. The drum is then grounded.

g. Always allow the exhaust system of a truck to cool. Head the truck into the wind, or air current, before removing the bung. This precludes any chance for the gases to reach the hot motor.

Carbon bisulphide on the hands or body may cause drying and irritation. If the material is spilled it should be washed off immediately to prevent such irritation. The fumes of carbon bisulphide may give one a severe headache if breathed for any length of time. Workers should always stay on the windward side of the material when handling it.

The above precautions may cause undue alarm but carbon bisulphide, when properly handled, is no more dangerous to handle than gasoline. It is well, however, to be thoroughly familiar with the hazards to prevent any possibility of accident.

Summary

Carbon bisulphide has become one of the main herbicides used in Idaho for the control and eradication of perennial weeds. Experimental and demonstrational plots to determine the effectiveness of carbon bisulphide as a herbicide for perennial noxious weeds, have been conducted in Idaho since 1926. The use of this material for weed eradication in the State has steadily increased until 350,000 gallons were applied during 1937.

Both the "Crystal Clear" and "Activated" grades of carbon bisulphide have been successfully used. However, the latter is better known and more widely used. Activated carbon bisulphide contains a catalytic agent which tends to hold the material in the ground over a longer period of time and is especially adapted to lighter, sandy soils.

Carbon bisulphide can be successfully used in Idaho for the control of such perennial weeds as wild morning glory, Russian knapweed, white top or hoary cress, Canada thistle, leafy spurge, perennial sow thistle, perennial ground cherry, blue flowering lettuce and other similar deep-rooted perennials.

The cost of this material limits its use to relatively small areas. In many cases, however, a high unit cost is justified in order to prevent further spread of noxious weeds over the farm. The eradication of small infestations of noxious weeds often influences the value of the whole farm.

Carbon bisulphide can be used on a wide range of soil types. "Adobe" and gravelly soils cannot be successfully treated with present methods of application.

All vegetation should be cleaned off areas to be treated with carbon bisulphide. It is advisable also to remove the crowns of the plants as sometimes re-growth occurs from these parts due to failure of gas to remain in the surface soil area long enough to permit a kill.

Carbon bisulphide should be applied only to land where the soil is moist clear to the surface. Satisfactory results cannot be obtained on dry soil with present methods of application.

The material is placed in holes 6 to 8 inches deep in staggered rows 18 inches apart. Two ounces of material are applied in each hole, at which rate approximately 2 gallons of material per square rod are required. Each hole should be thoroughly tamped immediately after application with a wooden tamper. Care should be taken to treat at least three feet beyond the farthest plant in an infested area to prevent a fringe of re-growth around the outside of the patches.

Follow-up work following treatment with carbon bisulphide is very important. The removal of surface growth by digging, together with shallow cultivations to kill any seedlings often will prevent reinfestation of the area.

Carbon bisulphide has caused soil sterility in only rare cases on extremely heavy soils. Deep plowing and aeration usually will correct this condition.

Carbon bisulphide is a highly volatile liquid and fumes are explosive. At all times fire in any form should be kept away from the material. Workers should not smoke near it. Serious accidents from careless handling of carbon bisulphide will be avoided if users of the material will familiarize themselves with the nature of it.